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about 1500 miles, making a grand total of about 17,000 miles of railroads in operation in South America.

Sir F. de Winton also states that the railway mileage of Australia reaches 11,000.

GEOLOGY AND PALEONTOLOGY.

Seeley's Researches on the Organization, Structure, and Classification of the Fossil Reptilia.¹—The Royal Society of Great Britain granted Prof. H. G. Seeley a sum to be expended in prosecuting researches among the extinct Reptilia, and the results obtained up to the present time are embodied in the memoirs now before us.

The first is on that ancient form, both geologically and in the literature, the *Protorosaurus speneri*. From the upper Permian of Germany, no form is more worthy of investigation, but the character of the matrix is such as to render the elucidation of the characters of the skeleton difficult. Dr. Seeley concludes that the genus *Protorosaurus* has no affinity with any form of reptiles known to him. His figures and descriptions add much to our knowledge of its characters, and, as a result, its place appears to me to be nearer to other genera of Permian age of Europe and South Africa. Accordingly I have (NATURALIST, October, 1889) placed it with them in the Theromora, to which location its characters distinctly point.

The second paper describes that remarkable form *Pariasaurus bombidens* Owen, from the Karoo Series of South Africa, which is of Permian or Triassic age. The new investigation is based on a nearly perfect skeleton in the collection of the British Museum, and the information furnished elucidates the systematic position of the genus almost completely. Dr. Seeley concludes that it belongs to the Theromora "Anomodontia"), and to a subdivision of that order which he calls the Pareiasauria. The characters of this suborder are as follows (p. 292, Philos. Trans., 1889, p. 292): "Occipital" condyle "basioccipital; no temporal vacuities; no median bar to interclavicle."² He shows that the ribs are single-headed, and attached to the diapophyses

¹ I. On *Protorosaurus speneri* Von Meyer (1887). II. On *Pariasaurus bombidens* Owen (1888). III. On *Theriodon phylarchus* Seeley (1888). IV. On the Anomodont Reptiles and their allies (1889). All from the Philosophical Transactions of the Royal Society, 1887-9.

² For scapular arch of *Diadectes*, see Proc. Amer. Philos. Society, 1883, p. 635.

only, and that intercentra are present. This reference by Dr. Seeley is essentially final, the only question being the minor one of the name of the suborder. In all important respects *Pareiasaurus* agrees with the *Diadectidae*, hitherto known only from the Permian formation of North America, and must be placed in the same sub-order. In the American forms the temporal fossa is overroofed in the same manner, and the ribs are single-headed. The articular face of the diapophysis is, however, prolonged downwards to the level of the centrum in the *Diadectidae*, though it originates entirely from the neural arch. Both types must be placed together in the suborder *Cotylosauria*, a name which has priority over *Pariosauria*. To the same order must be referred the genus *Phanerosaurus* Von Meyer, from the Permian of Saxony. In his studies of the relations of the intercentra to the vertebrae and the occipital condyle, Dr. Seeley has quite overlooked my own conclusions, with which he agrees, which I published in 1884³ and 1886⁴.

The memoir on the Theromorous reptiles ("Anomodontia") covers a wider range than those above mentioned, and concludes with some general conclusions as to the systematic arrangement of the order. Especially important is the description of the scapular arch in *Procolophon*, which turns out to have a well-developed coracoid and separate epicoracoid, which, with the clavicle and interclavicle, give the most monotrematous shoulder-girdle yet seen in the *Theromora*. Other important contributions are the descriptions of limb-bones and shoulder and pelvic girdles in *Dicynodon*, *Hyorhynchus*, *Eurycarpus*, etc. There is more information as to the characters of the skeleton of the South African *Theromora* to be found here than in any memoir yet published. In the systematic, several new divisions are introduced. The first, the *Procolophonina*, may turn out to be included in Baur's *Proganosauria*; but it is manifestly as well distinguished from the *Pelycosauria*, *Cotylosauria*, *Anomodontia*, and *Placodontia* as these are from each other. For the entire order Dr. Seeley uses the name *Anomodontia*, which we think should be restricted to the group to which Professor Owen originally gave it, viz.: the *Dicynodontia* of Seeley. The *Gennetotheria* (Seeley) do not seem to me to be distinguished from the *Theriodonta* of Owen, with which the *Pelycosauria* is more or

³ AMERICAN NATURALIST, p. 37, On the Batrachia of the Permian period of N. America.

⁴ Transac. American Philosoph. Society, p. 243, On the Intercentrum of the Terrestrial Vertebrata.

less coëxtensive, especially after the removal from them of the Cotylosauria.

The affinity to the Mammalia which Professor Owen saw in the humerus, and which I have pointed out in the skull, shoulder-girdle, fore-limbs, and hind-limbs and foot, is confirmed by Seeley's researches. He finds a fore-limb and foot of what he believes to be a veritable mammal in the same beds of the Cape, which is the subject of his third memoir, and which he refers to a species and genus under the name of *Theriodesmus phylarchus*. The probability of this determination being correct appears to me to be strong. The humero-cubital articulation is mammalian, and there is nothing in the pes forbidding the association. Dr. Bardeleben thinks that it has a præpollex with metacarpal and phalange. On this interpretation there is one large *os centrale*.

We are gratified to learn that Dr. Seeley has accepted the position of Director of the Geological Survey of the Cape, and we feel sure that important discoveries await him there in his chosen field.

E. D. Cope.

Devonian.—The *Geological Magazine* for January has some pretty full notes by Dr. R. H. Traquair upon some Devonian fishes from Scaumenac Bay and Campbelltown, now contained in the Edinburgh Museum. Most of the species have been described by Professor Whitteaves, but these notes give much information upon the Ctenodontidæ, Cephalaspidæ, Acanthodidæ, Holoptychidæ, Pleurichthiidæ, Palæoniscidæ, etc.

Mesozoic.—S. Nitchin gives an account of the Jurassic beds of the Himalayas and Middle Asia. The principal development of the Jurassic in the Himalayas is on the north-east slopes of the southern crystalline chain near Spiti and Niti, where dark crumbling shales known as the Spiti shales rest on beds said to be Lias and Rhætic. Phosphatic concretions are abundant, and ammonites plentiful. Opinions differ about the parallelism of the horizon, but it is generally thought that these shales are of the age of the Kelloway and Oxford clays. Nitchin thinks them more recent, and states that their fauna approaches nearest to that of the Tithon and Kimmeridge. The fauna of the Russian Jurassic is near that of Cutch.

Professor A. Pavloff believes that the Upper Jurassic of Russia is so near that of England that a common classification might be adopted. He describes as new three species of *Cleostephanus*, viz., *C. blaki*, *swindonensis* and *stenomphalus*.

M. G. Cotteau, after having described the Cretaceous echini of France, has now commenced with those of Spain. In Vol. VII., No. I., of the *Ann. de Sci. Nat.*, he treats of those collected in Oregon by M. Maur. Gourdon. The species are in great part identical with those previously described from French rocks.

Tertiary.—The *Revue Géographique* for January contains an account of the defile of the Danube by Attila de Gerundo. The writer believes that parts of this defile, which is 143 kilometres in length, were ancient valleys, and that a series of dislocations, the localities of which are marked by cliffs, at length opened a passage of communication between the Hungarian Sea and the Roumanian Bay of that larger inland sea of which the Black Sea is a remnant. Through this strait the waters of the sea poured, silting up the Roumanian Bay, until, when the outer sea retreated, the current swept the strait clear of sediment, and the Hungarian Sea ceased to exist, being replaced by the river network that at present exists.

A new edition of Dr. Burmeister's work upon the fossil Mammalia of the Argentine Republic, with considerable additions, has been recently issued. The Equidæ differ from all other Pampean ungulates in having the premolars longer than the true molars. Dr. Burmeister places the more generalized species of fossil horses in the genus *Hippidium*, which is distinguished from the modern *Equus* by the shorter and more curved crowns of the cheek teeth, which are of more simple general structure. The shape of the narial apertures also differs from that of the existing horses, the limbs are shorter, and the limb-bones stouter. In its teeth *Hippidium* approaches *Hipparion*, but the anterior pillar of the cheek teeth is connected with the anterior crescent, which is not the case with the latter genus. The Pliocene *Equus stenorhis* of Europe forms a connecting link between *Hippidium* and *Equus*. Additional remains of *E. curvidens*, *E. argentinus*, and *E. andium* are described, also a new *Hippidium* from Tarija in Bolivia. An entire skull of *Megatherium americanum* shows that our previous knowledge of the osteology of that animal was incomplete. In front of the short nasals this skull exhibits a large prenasal reaching almost to the premaxillaries, and there is also, projecting from the upper part of the maxillary, a lateral process coming forward into the nasal aperture. Probably the prenasal became united to the nasal in the adult. Another ossification extends upwards and backwards from the end of the premaxillary towards the prenasal. These two ossifications are the remains of the complete bony arch exhibited by *Mylodon darwini*,

which has been on this account generically separated under the name of *Gryptotherium*. Dr. Burmeister maintains the distinctness of *Mastodon andium* from *M. humboldti*, the latter attaining a larger size, and having more complex teeth; moreover, the dentine in the first species is always red, while in the second it is white. Remains of *Macrauchenia patachonica* and *M. paranensis* are also described. From the muscular impressions still remaining on the skull it is inferred that the nose was produced into a short proboscis, as in the existing tapir.

According to Dr. Roth's recent description of the structure of the pampean deposits, they contain in different proportions river, wind, lagoon, and coast beds. The coast deposits contain sand and marine shells; the lagoon beds are darker in color, and are much inferior in extent and thickness; while the river deposits, which contain large pebbles near to the mountains, become gradually finer as they recede from them. The beds formed by the few streams rising in the pampas themselves have round, smooth limestone concretions, as well as smooth fragments of bone. The æolic layers have vertical root-like tubes and irregular limestone concretions. The uniform character of the pampas loess does not, therefore, arise from its uniform origin, but from its long subjection to identical influences, to its transformation under the growth and decay of vegetation, and to wind and rain. Water carrying down and packing loose matter often makes the loess of the lower parts harder than that of the higher. In Entre Rios Dr. Roth observed that marine beds, probably of Miocene age, were lying over the typical Pampean, whence he concludes that the formation of the pampas loess commenced in Eocene times, grew in intensity in the diluvial, and is continuing at the present time.

In the *Geological Magazine* for January Mr. H. H. Howorth puts forward the theory that in the mammoth age the great Siberian rivers flowed southward into the central lake-sea.